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For: **METHOD FOR GENERATING AND TRANSMITTING OPTIMAL CELL ID CODES**

RE-SUBMISSION OF ENGLISH-LANGUAGE TRANSLATION OF CERTIFIED PRIORITY DOCUMENT

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Sir:

As a supplement to the Submission of the Substitute Specification filed March 3, 2006, attached is the English-language translation of Korean Application No. 10-1999-0054097 filed December 1, 1999, which was originally submitted on March 6, 2006. The Notice of Allowance indicates that this translation has not yet been received by the Patent Office. The Applicant hereby requests an acknowledgement of receipt of this translation.

Should there be any questions concerning this communication, please telephone the undersigned at the telephone number set forth below.

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DECLARATION

I, Sun YOU of 168-32, Seongbuk-gu, Seongbuk 1(il)-dong, Seoul, Republic of Korea declare that I have a thorough knowledge of the Korean and English language and the writings contained in the following pages are correct translation of the attached Korea Patent Application No. 10-1999-0054097.

This 06th day of March, 2006

BY Sun You

Sun YOU

KOREAN INTELLECTUAL PROPERTY OFFICE

This is to certify that the following application annexed hereto is a true copy from the records of the Korean Industrial Property Office.

Application Number: Patent Application No. 1999-0054097

Date of Application: December 01, 1999

Applicant(s): LG Electronics Inc.

COMMISIONER

[ABSTRACT OF THE DISCLOSURE]

[ABSTRACT]

The present invention relates to a third generation mobile communication, and more particularly, to a method for identifying an optimal cell (base station) using Hadamard code in a W-CDMA mobile communication system.

An object of the present invention is to provide a method for generating optimal cell ID codes for identifying each of the cells in a Site Selection Diversity Transmit (SSDT), and thus obtaining optimal diversity performance in a soft handover mode.

[TYPICAL DRAWING]

FIG. 1

[INDEX WORDS]

feedback identifier (FBI), Hadamard code

[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD FOR OUTPUTTING INFORMATION DURING CHANNEL CHANGE IN DIGITAL BROADCASTING RECEIVER

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 shows Hadamard codes for generating temporary ID codes according to the present invention.

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to a third generation mobile communication, and more particularly, to a method for identifying an optimal cell (base station) using Hadamard code in a W-CDMA mobile communication system.

In general, the Radio Access Network (RAN) standards of the Third Generation Partnership Project (3GPP) describe a Site Selection Diversity Transmit (SSDT) Power Control.

The SSDT, which is a selective macro diversity technique in a soft handover mode, allows a User Equipment (UE) to select one of cells in an active set called "Primary." In this instance, all other cells are classed as "Non-primary."

The main object of the SSDT is to transmit on the downlink from a primary cell, which reduces interference caused by multiple transmissions in a soft handover mode.

A second object of the SSDT is to achieve fast site selection without intervention from networks such as UMTS Terrestrial Radio Access Network (UTRAN), thus maintaining an advantage of the soft handover.

In order to select a primary cell, a temporary identification (ID) is assigned to every active cell having a transmission power level higher than a predetermined level, and the UE periodically informs a primary cell ID to other connected cells.

In this instance, the UE receives, measures, an compares power levels of common pilots from the respective active cells to select the primary cell, which has the greatest pilot power. Thereafter, the UE cuts off power from all other remaining cells which are non-primary cells.

An ID code for the primary cell is transmitted to cells in the active set through a Feed-Back Indicator (FBI) field among fields of a control channel, such as an up-link Dedicated Physical Control Channel (DPCCH). Next, the FBI is transmitted by 1 or 2 bits in one slot. If the FBI is transmitted by 1 bit, one radio frame is transmitted by 15 bits, and if the FBI is transmitted by 2 bits, one radio frame is transmitted by 30 bits, because one radio frame is transmitted by 15 time slots.

The operation of the SSDT for reducing interference caused by multiple transmission in the soft handover mode

will next be explained in more detail.

In a soft handover mode, the SSDT is initially activated by UTRAN based on the cells in the active set, and thereafter the UTRAN of the SSDT option activated during a present soft handover period informs the cell and the UE.

In this instance, a temporary ID is assigned to each active cell based on an order of the active set, and the assignment information on the IDs is given to the active cells and the UE.

Thus, an active cell can identify its entry position in the active list, by which the ID code can also be determined. At the same time, the UE receives the active list and can assign ID codes of to active cells based on the order of entry of the cells on the list. Therefore, the UTRAN and the UE have corresponding information of the ID codes and the cells. Moreover, the active list is renewed frequently and the renewed active list is provided to all active cells and the UE.

After the SSDT and UE acknowledgement are activated, the UE starts to transmit the ID code of the primary cell, and the active cells start to detect primary cell ID information following a successful SSDT activation and admission of the UE acknowledgement.

The setting of temporary cell ID will next be

explained.

A temporary ID is provided to cells during the SSDT for use as a site selection signal.

In the SSDT mode, when an upper layer decides to make transmissions between a UE and a cell, the UE designates the most appropriate cell in the active cells as the primary cell and informs the UTRAN through the FBI field.

Also, transmitting a signal to only one cell during the active SSDT mode can enhance a cell performance as intercellular interferences are reduced from the remaining other cells.

The temporary cell ID is given as a binary bit sequence having a particular bit length, which is shown in Tables 1 and 2, below.

Table 1 shows temporary ID codes when the FBI is transmitted by one bit per slot, and Table 2 shows temporary ID codes when the FBI is transmitted by two bits per slot.

As can be known from Tables 1 and 2, the temporary ID code may be in three forms of "Long," "Medium," and "Short," and there can be 8 codes for each of the forms. The temporary ID codes are required to be transmitted within one frame. If the space for sending a given ID code cannot be obtained within a frame, i.e. the entire ID cannot be transmitted within a frame but must be split over

two frames, the last bit(s) of the temporary ID code is (are) punctured.

[Table 1]

Identification Label	Identification Code		
	Long	Medium	Short
a	000000000000000	0000000(0)	00000
b	111111111111111	1111111(1)	11111
c	000000001111111	0000111(1)	00011
d	111111111000000	1111000(0)	11100
e	000011111111000	0011110(0)	00110
f	111100000000111	1100001(1)	11001
g	001111000011110	0110011(0)	01010
h	110000111100001	1001100(1)	10101

[Table 2]

ID Label	Identification Code		
	Long	Medium	Short
a	0000000(0)0000000(0)	0000000(0)	00000
b	1111111(1)1111111(1)	1111111(1)	11111
c	0000000(0)1111111(1)	0000111(1)	00011
d	1111111(1)0000000(0)	1111000(0)	11100
e	0000111(1)1111000(0)	0011110(0)	00110
f	1111000(0)0000111(1)	1100001(1)	11001
g	0011110(0)0011110(0)	0110011(0)	01010
h	1100001(1)1100001(1)	1001100(1)	10101

Referring to tables 1 and 2, when 1bit of FBI is transmitted per slot, the 8 long ID codes of 15 bit lengths

have a maximum cross-correlation value of "1" and a maximized minimum hamming distance 7 (d_{min}= "7") while the 8 medium ID codes of 7 bit lengths has a maximum cross-correlation value of "1" and a maximized minimum hamming distance 3 (d_{min}= "3"). Furthermore, the 8 short ID codes of 5 bit lengths has a maximum cross-correlation value of "1" and a maximized minimum hamming distance 2 (d_{min}= "2"). Here, for the medium ID code of 7 bits is made by puncturing the last bit of the ID code of 8bit lengths.

Furthermore, when two bits of FBI are transmitted per slot, the 8 long ID codes of 14 bit lengths have a maximum cross-correlation value of "2" and a maximized minimum hamming distance 6 (d_{min}= "6") while the 8 medium ID codes of 6 bit lengths and the 8 short ID codes of 6 bit lengths respectively have a maximum cross-correlation value of "2" and a maximized minimum hamming distance 2 (d_{min}= "2"). Here, for the long ID code of 14 bits, 2 bits of the last column of Table 2 are puncture, and for the medium ID code with a code length of 6, 2 bits of the last column are also punctured.

As described before, when the UE assigns one of the temporary ID codes as the primary cell ID code and sends the primary cell ID code after the SSDT and the UE acknowledgement, the primary cell ID code is sent through the FBI field in the uplink control channel, periodically.

Particularly, a cell is non-primary if the received primary ID code does not match with its own ID code or if the received uplink signal quality satisfies a quality threshold defined by UTRAN, where NID is a length (a number of bits) of the generated temporary ID.

The termination of the SSDT is determined by the UTRAN. Particularly, the UTRAN terminates the SSDT in a method identical to a procedure for terminating the soft handover, and informs the termination to all cells and the UE.

Thus, in the related art SSDT, performance of cell ID code used for identifying respective cells is dependent on the maximum cross-correlation value or the maximized minimum hamming distance. Accordingly, an optimal cell ID code which has a maximum cross-correlation value or a maximized minimum hamming distance is required, and a method for identifying a cell using the optimal cell ID code is required.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

Accordingly, the present invention is directed to a method for generating and transmitting optimal cell ID codes, that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide a

method for generating optimal cell Id codes for a soft handover.

Another object of the present invention is to provide a method for obtaining optimal diversity performance in a soft handover mode.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[PREFERRED EMBODIMENTS OF THE INVENTION]

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a method for generating and transmitting optimal cell ID codes includes allocating, at a UE, temporary identification (ID) codes generated based on Hadamard codes during an Site Selection Diversity Transmit (SSDT) to active cells; periodically measuring, at the UE, received power levels of common pilots transmitted from the active cells to select a primary cell; and periodically transmitting, at the UE, ID codes allocated to the selected primary cell to the active cells through a FBI

field of an uplink control channel.

In the above embodiment, the temporary ID codes may be generated by either deleting or puncturing first bits of the Hadamard codes in 8 bit lengths or 16 bit lengths, and transmitted to be inserted into a FBI field of each slot configuring each of radio frames in a control channel by 1bit or 2bits.

In addition, when the ID codes of the selected primary cell is inserted in the FBI field by 1bit, the cell ID codes of the selected primary field may be generated by puncturing first bits of the selected Hadamard codes of 16 bit lengths in case the allocated ID code has 15 bit lengths, and when the temporary ID code has 7bit lengths, the cell ID codes of the selected primary cell is generated by using the Hadamard codes of 8bit lengths, which then repeats the generation of the ID codes of the primary cell selected by the UE by one or more number of times, to puncture the exceeding bits over than the number of bits that can be transmitted per frame, so as to generate the ID codes of the selected primary cell by puncturing first, fifth and eighth bits of the selected Hadamard codes of 8 bit lengths when the ID code has 5 bit lengths.

In addition, when the ID codes of the selected primary cell is inserted in the FBI field by 2bits, the cell ID codes of the selected primary field may be

generated by puncturing first bits of the selected Hadamard codes of 16 bit lengths in case the allocated ID code has 14 bit lengths, and when the temporary ID code has 6bit lengths, the cell ID codes of the selected primary cell is generated by using the Hadamard codes of 8bit lengths, which then repeats the generation of the ID codes of the primary cell selected by the UE by one or more number of times, to puncture the exceeding bits over than the transmittable bits, so as to generate the ID codes of the selected primary cell by puncturing first bit among the 4bit couples of the selected Hadamard codes of 8 bit lengths when the ID code has 6 bit lengths.

It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

[PREFERRED EMBODIMENTS OF THE INVENTION]

Reference will now be made in detail to the preferred embodiments of the present invention associated with a method for outputting information during a channel change in a digital broadcasting receiver, examples of which are illustrated in the accompanying drawings.

Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like

parts.

Temporary cell IDs are provided for each unit of a binary bit sequence having a specific bit code length, and temporary cell ID codes suggested in the preferred embodiment are shown in Tables 3 and 4 below.

Namely, Table 3 shows temporary ID codes when the FBI is transmitted by one bit per slot, and Table 4 shows temporary ID codes when the FBI is transmitted by two bits per slot.

According to the current 3GPP standards, the FBI is also used for data bit transmission in closed loop transmit diversity.

As can be known from Tables 3 and 4, there are three types or forms of temporary ID code, "Long," "Medium," and "Short." Also, there can be 8 codes for each of the type. As in the related art, the temporary ID codes are required to be transmitted within one frame. However, if the space for sending a given ID code cannot be obtained within a frame, i.e. the ID code cannot be transmitted within a frame but must be split over two frames, the first bit or the first and second bits of the temporary ID code are punctured.

[Table 3]

Identification Label	Identification Code		
	Long	Medium	Short
a	000000000000000	(0)0000000	00000
b	101010101010101	(0)1010101	10110
c	011001100110011	(0)0110011	01101
d	110011001100110	(0)1100110	11011
e	000111100001111	(0)0001111	00011
f	101101001011010	(0)1011010	10101
g	011110000111100	(0)0111100	01110
h	110100101101001	(0)1101001	11000

[Table 4]

ID Label	Identification Code		
	Long	Medium	Short
a	(0)0000000(0)0000000	(0)000(0)000	00000
b	(0)0000000(1)1111111	(0)000(1)000	11111
c	(0)1010101(0)1010101	(0)101(0)101	00011
d	(0)1010101(1)1010101	(0)101(1)010	11100
e	(0)0110011(0)0110011	(0)011(0)011	00110
f	(0)0110011(1)1001100	(0)011(1)100	11001
g	(0)1100110(0)1100110	(0)110(0)110	01010
h	(0)1100110(1)0011001	(0)110(1)001	10101

Of the temporary Id codes shown in Tables 3, when one FBI bit per slot is transmitted, eight long ID codes with code lengths of 15 bits have a maximum cross correlation function value of "-1" and a maximized minimum Hamming distance value of 8 (d_{min}="8"). Eight medium ID codes with

code lengths of 7 bits have a maximum cross correlation function value of "-1" and a maximized minimum Hamming distance value of 4 (d_{min}="4"), while eight short ID codes with code lengths of 5 bits have a maximum cross correlation function value of "1" and a maximized minimum Hamming distance value of 2 (d_{min}="2"). Here, the medium ID codes with a code length of 7 bits are generated by puncturing the last bit of the ID codes with a code length of 8bits.

Of the temporary ID codes shown in Table 4, when two FBI bits per slot is transmitted, eight long ID codes with code lengths of 14 bits have a maximum cross correlation function value of "0" and a maximized minimum Hamming distance value of 7 (d_{min}="7"). Eight medium ID codes with code lengths of 6 bits and eight short ID codes with code lengths of 6 bits respectively have a maximum cross correlation function value of "0" and a maximized minimum Hamming distance value of 3 (d_{min}="3"). Here, the long ID codes with a code length of 14 bits are generated by puncturing the two bits corresponding to the first column in Table 4. Also, the medium ID codes with a code length of 6 bits are generated by puncturing the 2 bits corresponding to the first column of Table.

A UE periodically measures received power levels of pilots transmitted by active cells of the UE, so that a

cell having a received power level greater than a threshold value is selected as a primary cell. The primary cell ID code is transmitted through the FBI field of an uplink control channel.

In the preferred embodiment of the present invention, the temporary ID codes of Tables 3 and 4 are generated using the Hadamard codes.

Particularly, FIG. 1 shows Hadamard codes having code lengths of 8 bits and 16 bits.

A method for generating the temporary ID codes based on the Hadamard codes of FIG. 1 will be described below. In the present invention, considering that the first bits of the Hadamard codes are all "0," bits punctured at a transmitting party can be recognized in advance when the temporary ID codes are decoded by a receiving party. Thus, decoding gain is obtained.

The temporary ID codes corresponding to a case where one FBI per slot is transmitted as shown in Table 3 are generated as follows. In this case, the first bit of each Hadamard code is either deleted or punctured considering that the first bit of each Hadamard code is "0." This is because there is no reduction of the Hamming distance for a set temporary ID code.

The eight long ID codes having a code length of 15 bits are generated by puncturing the first bit of the

Hadamard codes having a code length of 16 bits.

The eight medium ID codes having a code length of 7 bits are generated using the Hadamard codes having a code length of 8 bits. However, the code length that can be inserted and transmitted by each frame is 15 bits. Thus, for each frame, the medium ID codes with a code length of 8bits can be repeated twice and transmitted. Since the ID codes generated by repeating twice the Hadamard codes of 8 bits exceeds the number of bits that can be transmitted per frame by 1 bit, the ID codes are transmitted after puncturing the first bit of one of the Hadamard codes of 8 bits as shown in Table 3.

The eight short ID codes having a code length of 5 bits are generated by puncturing the first bit, the fifth bit, and the eight bit of the Hadamard codes having a code length of 8 bits.

The temporary ID codes corresponding to a case where two FBI per slot is transmitted as shown in Table 4 are generated as follows. Since the first bits of the Hadamard codes are all "0," the first bit of each Hadamard code is punctured.

The eight long ID codes having a code length of 14 bits are generated using the Hadamard codes having a code length of 16 bits. In this case, since the number of bits that can be inserted and transmitted in one frame is 30

bits, the long ID codes using the Hadamard codes of 16 bits can be repeated twice. However, if the Hadamard codes of 16 bits is repeated twice, the number of bits that can be transmitted per frame is exceeded by 2 bits. Accordingly, the ID codes are transmitted after puncturing the first bits of the first column from one of the repeated Hadamard codes of 16 bits as shown in Table 4.

The eight medium ID codes having a code length of 6 bits are generated using Hadamard codes having a code length of 8 bits. In this case, since code length that can be inserted and transmitted by one frame is code length of 30 bits, the medium ID codes based on the Hadamard codes of 8 bits can repeat four times. However, the medium ID codes based on the Hadamard codes of 8 bits exceed the number of bits that can be transmitted per frame, by 2 bits when repeated four times. Accordingly, the ID codes are transmitted after puncturing the first bits of the first column from one of the repeated Hadamard codes of 8 bits as shown in Table 4.

The eight short ID codes having a code length of 6 bits are generated by deleting a pair of bits, i.e. the first bits of the first column, from the Hadamard codes having a code length of 8 bits.

As discussed above, upon activating acknowledgment of the SSDT and the UE, the UE determines one of the temporary

ID codes as a primary cell ID code. Thus, the primary cell ID code is periodically transmitted to the active cells within the active set through the FBI field of the uplink control channel.

Furthermore, in the present invention, other temporary ID codes are suggested as shown in Table 5.

Table 5 shows temporary ID codes corresponding to a case where the temporary ID codes are inserted one FBI bit per slot and transmitted.

[Table 5]

Identification Label	Identification Code		
	Long	Medium	Short
a	000000000000000	(0)0000000	00000
b	101010101010101	(0)1010101	11111
c	011001100110011	(0)0110011	00011
d	110011001100110	(0)1100110	11100
e	000111100001111	(0)0001111	00110
f	101101001011010	(0)1011010	11001
g	011110000111100	(0)0111100	01010
h	110100101101001	(0)1101001	10101

The temporary ID codes of Table 5 have a different short code among 3types of codes, "Long", "Medium" and "Short." In other words, under the current 3GPP standards, when the FBI is transmitted by 1 bit per slot, the short ID codes have an optimized cross correlation value of "2." Accordingly, the short ID codes existing in the related art

can be used.

The temporary code suggested by the present invention can not only used in SSDT, but also used by UE to transfer cell information to UTRAN. In this case, the temporary ID codes can be optimized for the cross correlation characteristics and the Hamming distance.

[EFFECT OF THE INVENTION]

As described above, the method for generating and transmitting optimal cell ID codes according to the present invention has the following advantages.

Since the respective cells are identified in the SSDT by combining and generating the cell ID codes based on the Hadamard codes and the bi-orthogonal codes, use of the ID codes having a period of high speed can be maximized, thereby maximizing system performance in the fading channel. Furthermore, in receiving the cell ID codes according to the present invention to decode them, bits punctured at the transmitting party can be recognized in advance by the receiving party. Accordingly, decoding gain can be obtained.

In addition, in the present invention, the cell ID codes are generated to have a minimum Hamming distance with a maximum value and a small absolute value of the maximum correlation function by combining the Hadamard codes and the bi-orthogonal codes. Thus, optimal diversity performance can be obtained in the soft handover mode.

What is claimed is:

1. A method for generating and transmitting optimal cell ID codes comprising the steps of:

allocating, at a UE, temporary identification (ID) codes generated based on Hadamard codes during an Site Selection Diversity Transmit (SSDT) to active cells;

periodically measuring, at the UE, received power levels of common pilots transmitted from the active cells to select a primary cell; and

periodically transmitting, at the UE, ID codes allocated to the selected primary cell to the active cells through a FBI field of an uplink control channel.

2. The method as claimed in claim 1, wherein the temporary ID codes may be generated by puncturing first bits of the Hadamard codes in 8 bit lengths or 16 bit lengths.

3. The method as claimed in claim 1, wherein the ID codes are transmitted to be inserted into a FBI field of each slot configuring each of radio frames in a control channel by 1bit or 2bits.

DRAWINGS

FIG. 1

Hadarmad codes of 8 bits	Hadarmad codes of 16 bits
$H_{3,0}$ =0000 0000	$H_{4,0}$ =0000 0000 0000 0000
	$H_{4,1}$ =0101 0101 0101 0101
$H_{3,1}$ =0101 0101	$H_{4,2}$ =0011 0011 0011 0011
	$H_{4,3}$ =0110 0110 0110 0110
$H_{3,2}$ =0011 0011	$H_{4,4}$ =0000 1111 0000 1111
	$H_{4,5}$ =0101 1010 0101 1010
$H_{3,3}$ =0110 0110	$H_{4,6}$ =0011 1100 0011 1100
	$H_{4,7}$ =0110 1001 0110 1001
$H_{3,4}$ =0000 1111	$H_{4,8}$ =0000 0000 1111 1111
	$H_{4,9}$ =0101 0101 1010 1010
$H_{3,5}$ =0101 0101	$H_{4,10}$=0011 0011 1100 1100
	$H_{4,11}$=0110 0110 1001 1001
$H_{3,3}$ =0011 1100	$H_{4,12}$=0000 1111 1111 0000
	$H_{4,13}$=0101 1010 1010 0101
$H_{3,7}$ =0110 1001	$H_{4,14}$=0011 1100 1100 0011
	$H_{4,15}$=0110 1001 1001 0110